

Reexamination of Spent Fuel Shipment Risk Estimates

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ABSTRACT

The risks associated with the transport of spent nuclear fuel by truck and rail are reexamined and compared to results published in NUREG-0170 and the Modal Study. The reexamination considers transport by truck and rail in four generic Type B spent fuel casks. Cask and spent fuel response to collision impacts and fires are evaluated by performing three-dimensional finite element and one-dimensional heat transport calculations. Accident release fractions are developed by critical review of literature data. Accident severity fractions are developed from Modal Study truck and rail accident event trees, modified to reflect the frequency of occurrence of hard and soft rock wayside route surfaces as determined by analysis of geographic data. Incident-free population doses and the population dose risks associated with the accidents that might occur during transport are calculated using the RADTRAN 5 transportation risk code. The calculated incident-free doses are compared to those published in NUREG-0170. The calculated accident dose risks are compared to dose risks calculated using NUREG-0170 and Modal Study accident source terms. The comparisons demonstrate that both of these studies made a number of very conservative assumptions about spent fuel and cask response to accident conditions, which caused their estimates of accident source terms, accident frequencies, and accident consequences to also be very conservative. The results of this study and the previous studies demonstrate that the risks associated with the shipment of spent fuel by truck or rail are very small.

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ACRONYMS

AAR	American Association of Railroads
ANL	Argonne National Laboratory
BDF	building dose factor
BMCS	Bureau of Motor Carrier Safety
BWR	boiling water reactor
CCDF	Complementary Cumulative Distribution Function
DOE	Department of Energy
DOT	U.S. Department of Transportation
DU	depleted uranium
EIS	Environmental Impact Statement
EQPS	Equivalent Plastic Strain
G	acceleration due to gravity
GES	General Estimates System
GIS	Geographic Information System
GWDt/MTU	gigawatt-days thermal per metric ton of uranium
LCF	latent cancer fatalities
LHS	Latin Hypercube Sampling
LLNL	Lawrence Livermore National Laboratory
LOS	loss of shielding
MPC	multi-purpose cask
NMSS	Nuclear Material Safety and Safeguards
NRC	Nuclear Regulatory Commission
PWR	pressurized water reactor
RAM	radioactive material
SETU	Structural Evaluation Test Unit
SNL	Sandia National Laboratories
TE	total plastic elongation
TIFA	Trucks Involved in Fatal Accidents
UE	uniform plastic elongation
USGS	U.S. Geologic Survey

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